

Mining		PROJECT DATA	
Southwest Texas State University - 02GO12064			
Remote Temperature Measurement in Hostile Industrial Environments with Microwave Radiometry			
Recipient:	Southwest Texas State University	Instrument Number:	DE-FG36-02GO12064
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Subcontractor(s):		B&R Number(s):	ED190602
		PES Number(s):	02-2140
EERE Program:	Industrial Technologies	State Congressional District	TX - 14
<p>PROJECT SCOPE: The two primary goals for this project are: 1) build a microwave radiometric temperature sensor suitable for field use at industrial sites and 2) test the sensor at three different field sites to verify its usefulness under conditions that prevent other remote temperature sensors from operating. A low-cost microwave radiometer designed for field use will be constructed for testing. Results will be published and the technology will be transferred to a firm interested in commercialization. Across the board energy savings of 1% are expected, saving 31.56 trillion Btu/year, or \$129 million/year. Reduced energy consumption will lower carbon equivalent emissions by an estimated 559,000 metric tons per year.</p>			
FINANCIAL ASSISTANCE			
Approved DOE Budget	\$199,990	Approved DOE Share	\$199,990
Obligated DOE Funds	\$199,990	Cost Share	\$98,737
Remaining Obligation	\$0		
Unpaid Balance	\$114,305	TOTAL PROJECT	\$298,727
Project Period: 7/25/02-7/24/04			

TECHNICAL PERFORMANCE
DE-FG-36-02GO12064
Southwest Texas State University
Remote Temperature Measurement in Hostile Industrial Environments with Microwave Radiometry

PROJECT SYNOPSIS

The two primary goals of this project are (1) to build a microwave radiometric temperature sensor suitable for field use at industrial sites and (2) to test the sensor at three different field sites to verify its usefulness under conditions that prevent other remote temperature sensors from operating. Other goals include the publication of results and transfer of technology to a firm interested in commercializing the product.

Bench-scale tests have shown this method provides accurate temperature data on materials of commercial interest. They plan to build a low-cost microwave radiometer designed for field use. They will install the device at three different field sites and compare its performance to the best existing temperature monitoring equipment. The experience gained through this project should provide enough justification for commercial development of the instrument, with a potential energy cost savings of over \$100 million annually. Across the board energy savings of 1% are expected, translating into savings of 31.56 trillion Btu/year, or \$129 million/year. The reduced energy consumption also reduces the carbon equivalent emissions from these industries by an estimated 559,000 metric tons per year.

SUMMARY OF TECHNICAL PROGRESS

A major low-frequency circuit redesign was undertaken in the fall of 2003 to correct unanticipated noise and stability problems found during field trials. This corrected a design flaw which was the primary cause of drift in the instrument and added a feature which automatically compensates for errors caused by ambient temperature changes that affect the instrument's internal temperature. Verification tests of the redesigned instrument show that drift is now essentially negligible over a period of several hours. Experiments have proven its superiority to infrared remote sensing of temperature when dense clouds of fog or dust are present.

Due to the redesign, the instrument is currently in an auxiliary housing which makes it impossible to use in field trials. New circuit boards have been ordered which will allow the redesigned instrument to be packaged in its original sealed housing, required for field trials.

Two graduate students at the University of Texas School of Business have agreed to undertake the identification of possible field trial sites and conduct related market research activities at no cost to the project.

SUMMARY OF PLANNED WORK

The redesigned instrument will be repackaged in its original sealed housing. Once additional verification tasks are performed for calibration, the field trials will commence. Based on laboratory tests, a field trial at a steel mill will be likely. Field trials may also be conducted at cement plants and food processing plants.

PROJECT ANALYSIS

The project is somewhat behind schedule due to a necessary redesign of the low-frequency circuits. The project is still moving ahead and the budget is only slightly behind. Based on the reports, the major obstacles have been overcome.

A utility patent was applied for, using University funds, based on a previously held provisional patent. Two papers have been accepted for presentation at conferences during the summer of 2004 describing the experimental results obtained with the instrument. One will be presented at the June 2004 IEEE Microwave Theory and Techniques Society International Microwave Symposium. It describes the results of experiments in which temperature was sensed through clouds of dust or fog. The other paper will be presented at the International Microwave Power Institute annual meeting in July 2004. This paper describes how the instrument can remotely sense temperature inside a microwave oven during the heating cycle.

ACTION REQUIRED BY DOE HEADQUARTERS

No action is required from DOE Headquarters at this time.

STATEMENT OF WORK
DE-FG36-02GO12064
Southwest Texas State University
Remote Temperature Measurement in Hostile Industrial Environments with Microwave Radiometry

Detailed Task Description

Task 1.1 Radiometer Design

The radiometer unit will be designed to be compact, stable, reliable, rugged, and portable enough for extensive field tests. The PI will lead this design effort and UT staff will assist.

Task 1.2 Equipment and Component Procurement

Certain test equipment for field testing and servicing is required at SWT, and components for the radiometer unit will be purchased at this time.

Task 1.3 Radiometer Assembly

The radiometer will be assembled at UT under the supervision of the PI and co-investigator. Initial troubleshooting and modifications as necessary will be performed at this time.

Task 2.1 Lab Verification Tests

These tests, performed at UT, will verify the accuracy and stability of the unit with laboratory-grade equipment.

Task 2.2 Field Verification Tests

These tests will be performed at a variety of field sites where materials of known properties and temperatures are being processed. The results of these tests will reveal any problems that may arise in the field before actual field trials begin.

Tasks 3.1-3.3 Field Trials

Three different field sites, with a high potential to gain advantages from the use of this technology, will be identified with the assistance of the industrial partner. At each site, the instrument will be set up in a temporary installation and its output made available to plant personnel for process monitoring and control purposes. After a suitable time (2-4 weeks), comparison of instrument data with other process data and interviews with plant personnel will form the basis of the field trial evaluation.

Tasks 4.1-4.2 Reports

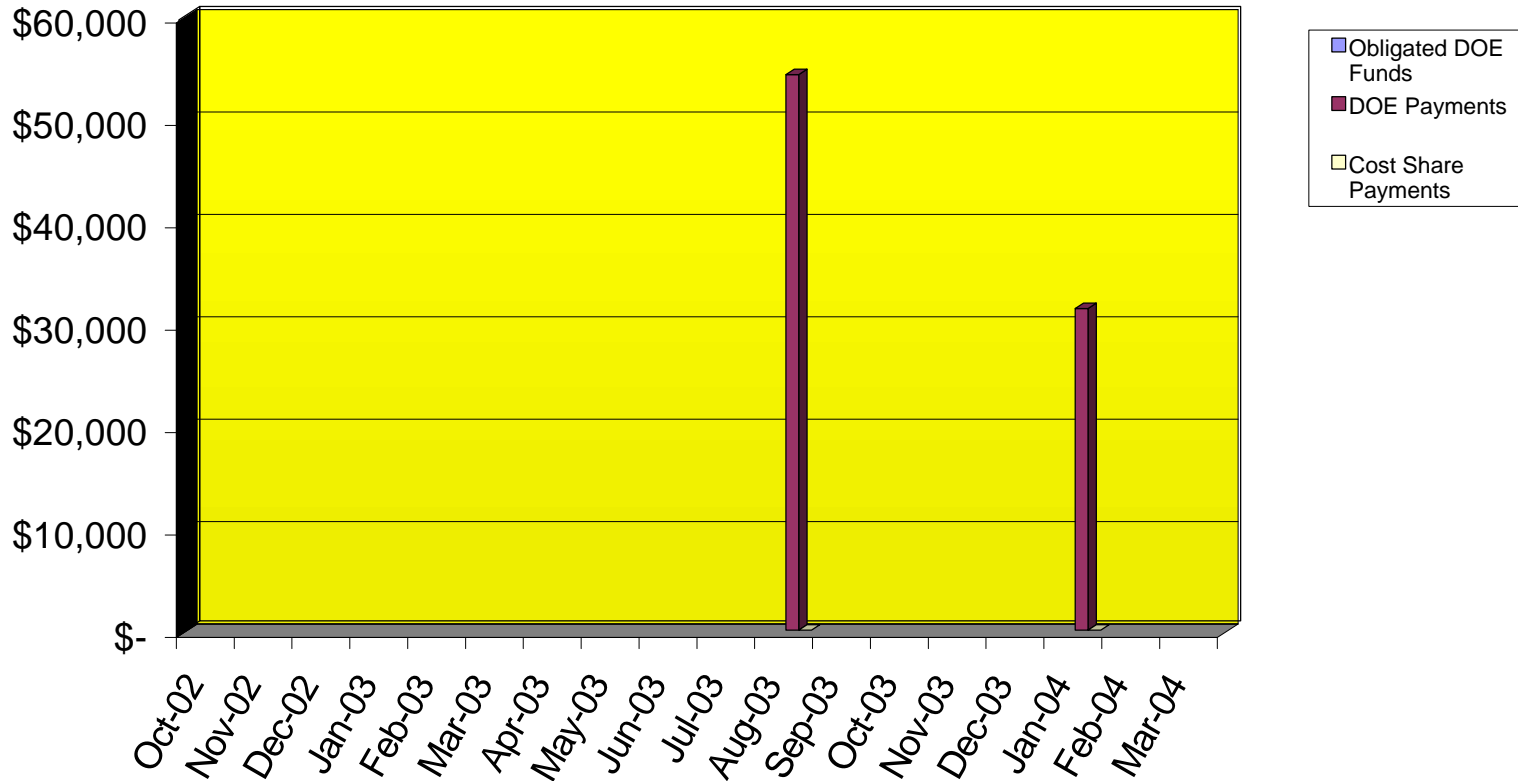
Semi-annual reports will be submitted to DOE on 5/1/2003, 10/1/2003, and 5/1/2004, with a final report no later than 12/1/2004.

Project Cost Performance in DOE Dollars for Fiscal Year 2003

DE-FG36-02GO12064

Southwest Texas State University

Remote Temperature Measurement in Hostile Industrial Environments with Microwave Radiometry



	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03
Obligated DOE Funds	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
DOE Payment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$54,263	\$0
Cost Share Payment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	PFY*	Cumulative
Obligated DOE Funds	\$0	\$0	\$0	\$0	\$0	\$0	\$199,990	\$199,990
DOE Payment	\$0	\$0	\$0	\$31,421	\$0	\$0	\$0	\$85,685
Cost Share Payment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Approved DOE Budget:	\$199,990
Approved Cost Share Budget:	\$98,737
Total Project Budget:	\$298,727

* Prior Fiscal Years

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ID	Task Name	02		2003				2004			
		Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
1	Task 1: Complete Radiometer Assembly	<div></div> 100%									
2	Task 2: Radiometer Verification Tests	<div></div> 50%									
3	Task 3: Complete Field Trials	<div></div> 0%									
4	Task 4: Project Management	<div></div> 75%									